

CHAPTER 2

REDUCING WASTEWATER GENERATION

Using water more effectively reduces both the need for high quality water and the amount of wastewater generated. Reducing the water sent to onsite wastewater treatment systems may improve the overall process performance by reducing the hydraulic loading and, in some cases, providing a more stable wastewater flow. The topics to be considered in this section include: (1) water usage, (2) water conserving fixtures, (3) low water appliances, (4) efficient water heaters, (5) water saving toilets and urinals, and (6) greywater separation.

2-1 Water usage

The choice to use water more efficiently reduces water needs and wastewater generation. An important first step to water conservation is to realize how much water various activities use. A summary of common household water usage is presented in Table 2-1.

Table 2-1

Wastewater generation estimated by water usage for various activities^a

Water usage	Water use, gal/cap·d	
	Conventional	Conservative
Toilet flushing	17.5	8
Bathing/showering	20	10
Bathroom sink	10	5
Dish washing		
Manual	20	10
Automatic	10	5
Clothes washing	15	7
Total	92.5	45

^a The use of a water softener will increase water usage. In addition, the brine discharged from water softeners may inhibit the effectiveness of subsequent wastewater treatment processes.

Water saving activities can include

- > Using clothes washing machines and dish washers at maximum capacity (newer appliances automatically sense and compensate for partial loads)
- > Only using water for wetting and rinsing when showering
- > Promptly repairing leaking faucets and toilet valves

Additional information on water usage and conservation can be obtained from the following organizations

2-1.1 WaterWiser

6666 West Quincy Avenue
Denver, CO 80235
Phone (800) 926-7337
Fax (303) 347-0804
E bewiser@waterwiser.org
Web www.waterwiser.org

Description

WaterWiser is a program of the American Water Works Association operated in cooperation with the U.S. Bureau of Reclamation. Website includes manufacturers of water conserving products and educational material database. Online drip calculator at <http://www.waterwiser.org/books/wwdripcalc.htm>

2-1.2 California Urban Water Council

H2OUSE website

E webmaster@cuwcc.org

Web www.h2ouse.org

Description

An excellent resource on water usage and conservation information.

2-1.3 Federal Energy Management Program

FEMP's Energy Cost Calculator

Web <http://www.eren.doe.gov/femp/procurement/calc-index.html>

Description

On-line water and energy savings calculator.

2-2 Flow reducers

Water saving fixtures and appliances are easy to install and can reduce the amount of water used for daily household activities. By reducing the amount of wastewater generated, treatment processes will be less likely to fail or have poor performance due to hydraulic overloading. The following is a partial list of organizations, manufacturers, and distributors who provide information and technologies for water conservation. Flow reducers and faucet aerators reduce the flow rate of water during normal faucet or shower usage. Flow control devices include in-line valves that allow the water flow rate to be set manually or in-line flow restrictors that restrict the flowrate.

2-2.1 AM Conservation Group

430 Sand Shore Road, Suite 7

Hackettstown, NJ 07840 USA

Phone (908) 852-6464; (908) 852-6244

Fax (908) 852-6444; (908) 852-7614

E amcg@nac.net

Web www.amconservationgroup.com

Description

AM Conservation distributes various water saving devices including faucet aerators, toilet flush volume reducing components, and accessories for more efficient irrigation.

2-2.2 Jet Blast Incorporated

6800 Fort Smallwood Road

Baltimore, Maryland 21226

Phone (410) 636-0816

Fax (410) 636-0819

E productsales@jetblast.net

Web www.jetblast.net

Description

Manufactures low flow shower heads, models less than 1 gallon per minute.

**Figure 2-1**

Examples of water saving devices (from left to right): in-line flow control valve, faucet aerator, faucet aerator with on-off control, and low flow showerhead. (Adapted from Niagara Conservation, Inc.)

2-2.3 Niagara Conservation

45 Horsehill Rd.

Cedar Knolls, NJ 07927

Phone (800) 831-8383; (973) 829-0800

Fax (973) 829-1400

E scotth@niagaraconservation.com

Web www.niagaraconservation.com

Description

Niagara is a manufacturer of high efficiency residential conservation products and developer of turnkey conservation solutions. A complete line of showerheads, faucet aerators, ultra-low-flow toilets, and high efficiency lighting products.

2-2.4 Real Goods

13771 S. Highway 101

Hopland CA 95449

Phone (707) 744-2017

Fax (707) 744-1682

Web www.realgoods.com

Description

Products and information on water and energy conservation.

2-3 Low water appliances

Dishwashers and washing machines are both available in low water (and low energy) models. Energy and water efficient dishwashers use between 5 and 8 gal/load. Many current dishwashers do not require pre-rinsing of dirty dishes, further reducing the amount of wastewater generated. Most washing machine manufacturers offer horizontal axis washing machines that reduce the volume of water used for clothes washing. In addition to energy savings, horizontal axis washing machines reduce water usage by an estimated 30 to 50 percent as compared to the vertical axis washing machine. Contact local appliance store for information on specific models. The cost of high-efficiency clothes washing machines is higher than conventional washers; however, state sponsored rebate programs can make the purchase price of water and energy saving appliances more competitive. In addition, the long-term savings can be significant. The magazine *Consumer Reports* (www.consumerreports.org) provides testing services, including water and energy usage for many appliances and may be used as a guide for model selection.



Figure 2-2

Examples of high efficiency washing machines: (left) 17.3 gal/load and 196 kWh/y (based on Energyguide estimate); and (right) 15.8 gal/load and 286 kWh/y (based on Energyguide estimate). Average water usage is 42.4 gal/load for a conventional washing machine. (Adapted from Sears, Inc.)

2-4 Efficient water heaters

Conventional plumbing systems require cold water to be purged from the line, while hot water travels from the hot water heater to the point of use. The cold water that exits the system (typically 3 to 7 gallons) while waiting for hot water, contributes to household wastewater generation. To reduce the amount of water that is discharged, technologies are available that either (1) heat the water at the point-of-use or (2) return cold water to the water heater.

Instant (point-of-use) hot water systems

Hot water heaters that heat water directly before use are known as instant, or point-of-use, hot water heaters. The water heater is located adjacent to the application where hot water is used. These systems can use either gas or electricity to heat water. When there is a hot water demand, the system is activated automatically and hot water is produced, reducing energy losses in the distribution system and cold water loss down the drain. In addition to those listed below, many manufacturers of appliances and plumbing supplies offer instant hot water dispensers.



Figure 2-3

Example of an under the sink point-of-use instant hot water heater. (Adapted from Controlled Energy Co.)

2-4.1 SETS

2500 E Commercial Blvd
Ft. Lauderdale, FL 33308
Phone (877) 666-8265
Fax (954) 772-5651
E sales@tankless-water-heater.com
Web www.tankless-water-heater.com

Description

The SETS Model 110 is an 11 KW two element water heater designed for point of use applications. It can be used in under-sink instant hot water applications in homes and offices in warmer climates.

2-4.2 Controlled Energy Corp.

340 Mad River Park
Waitsfield, VT 05673
Phone (802) 496-4436; (800) 642-3111
Fax (802) 496-6924
E sales@controlledenergy.com
Web www.controlledenergy.com

Description

Two models of instant electric water heaters, Ariston and Powerstream.

2-4.3 In-Sink-Erator®

4700 21st St
Racine, WI 53406-5093
Phone (800) 558-5700
Web www.insinkerator.com

Description

Several models of instant hot water heaters.

2-4.4 KithenAid®

1901 Minnesota Court
Mississauga, ON, Canada L5N 3A7
Phone (800) 461-5681
E appliances@kitchenaid.ca
Web www.kitchenaid.ca

Description

Hot water dispenser delivers water as hot as 190 °F at the tap, up to 3.75 gal per hour. Water flow stops automatically when knob is released.

Cold water return systems

For applications that use a hot water tank for heating water, cold water return devices can be installed to reduce wastewater. The cold water return concept uses a device that senses the temperature of the water (at the point-of-use) during a hot water demand. If the water temperature is less than a preset level, the water is returned to the hot water tank via the cold water supply line or a separate return line. After the water reaches the correct temperature, a valve is opened to allow hot water flow to the intended use. In addition, cold water return systems generally have a pump to accelerate the flow of hot water to the application.

2-4.5 ACT, Inc Metlund® Systems

3176 Pullman Avenue, Suite 119
Costa Mesa, California 92626
Phone (714) 668-1200; (800) 638-5863
Fax (714) 668-1927
E info@gothotwater.com
Web www.metlund.com

Description

The Metlund Hot Water D'MAND® System consists of an electronically controlled pump and valve assembly that allows for the rapid delivery of hot water to plumbing fixtures without the loss of cold water.

2-4.6 Central Plastics

245 Bateman Dr.
Central Point, OR 97502
Phone (800) 914-9887
E sales@chilipepperapp.com
Web www.chilipepperapp.com

Description

The Chilipepper™ recirculates cold water back to the water heater through the cold water line under your sink, shutting off before hot water enters the cold water line.

2-5 Water saving toilets and urinals

Various toilets and urinals are available that reduce or eliminate the amount of water used for flushing activities. Many of the products listed below were originally designed for mobile applications.

Waterless toilets, low flush toilets, and dual flush toilets and urinals

The companies listed below offer products that use much less water for flushing purposes than standard toilets and urinals.

2-5.1 Microphor, Inc.

452 East Hill Rd.
Willits, CA 95490 USA
Phone (707) 459-5563; (800) 358-8280
Fax (707) 459-6617; (707) 459-4365
E info@microphor.com
Web www.microphor.com

Description

Models available that use only 16 ounces, one quart or one half gallon of water per flush. They operate on compressed air, with rear or downward discharge and internal or remote flush activators, depending on the model selected.

2-5.2 Sealand Technology, Inc.

PO Box 38, Fourth St.
Big Prairie, OH 44611
Phone (330) 496-3211; (800) 321-9886
Fax (330) 496-3097
E sealand@sealandtechnology.com
Web www.sealandtechnology.com

Description

Vacuum flush toilets that use as little as one pint of water per flush.

2-5.3 Waterless Co.

1223 Camino Del Mar
Del Mar, CA 92014
Phone (888) 663-5874; (858) 793-5393
Fax (858) 793-5661
Web www.waterless.com

Description

Manufactures waterless urinals. Urinal is designed to allow urine to pass through into wastewater collection system, without the need to flush.

2-5.4 Caroma International

P.O.Box 97; Pascoe Vale South
Victoria 3044 Australia
Phone + 61 3 9926 5477
Fax + 61 3 9354 0017
E export@caroma.com.au
Web www.caroma.com.au

Description

Dual flush toilets in the United States, on average reduces water usage to 1 gallon per flush.

2-5.5 Ecotech

Phone (978) 369-3951
E ecotech@ecological-engineering.com
Web www.ecological-engineering.com/ecotech.html

Description

Distributors of various low flush and waterless toilets including Nepon foam flush toilet, Sealand, dry toilets, and bowl liners (for custom toilets).

2-5.6 Envirovac Inc.

1260 Turret Drive
Rockford, IL 61115-1486
Phone (815) 654-8300
Fax (815) 654-8306
E building@evac.com
Web www.envirovacinc.com

Description

Evak Vacuum-Flush toilet system

Urine separating toilets

Urine separation is often used with composting toilet systems and in dry toilets. Because urine contains a large amount of the nitrogen in household wastewater (up to 90 percent), separation of this fluid may make it possible to treat or reuse the high nitrogen component of the wastewater in a separate process. In other countries source separated urine is being used as a fertilizer in agricultural systems. The urine is stored in large cisterns and periodically pumped out for reclamation. A small nitrifying filter may be used to convert the nitrogen to a non-volatile form, making the urine more valuable for agricultural application. In areas that are sensitive to nitrogen loading, urine diverting toilets offer an interesting alternative to advanced wastewater treatment processes which attempt to denitrify.

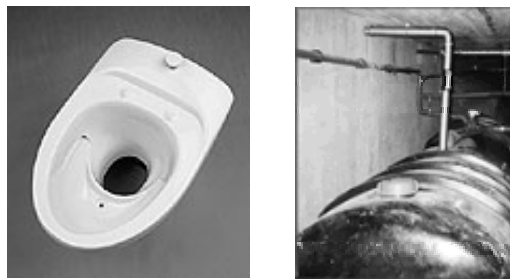


Figure 2-4

Typical view of a urine diverting toilet (left) and a cistern for collection of urine located in the basement of a building. (Adapted from EcoTech.)

2-5.7 Servator Separett AB

Skinnebo, SE-330 10

Bredaryd, Sweden

Phone +46-371-71220

Fax +46-371-71260

E info@separett.com

Web www.separett.com

Description

Waterless and urine separating toilet system.

2-5.8 EcoTech

50 Beharrell Street

Concord, MA 01742-2973

Phone (978) 369-3951

Fax (978) 369-2484

E ecotech@ecological-engineering.com

Web www.ecological-engineering.com

Description

Urine diverting, micro-flush and waterless toilets made by Ekologen of Sweden.

2-6 Greywater separation and dual plumbing

Greywater is water from non-toilet sources and accounts for a majority (60 to 80 percent) of the household wastewater. Wastewater from toilets, kitchen sinks, dishwashers, and the laundry of diapers is not included in greywater. Source separation of greywater and blackwater can provide more options for the onsite management of wastewater. In California, the standards for greywater systems are part of the State Plumbing Code. The most common use of greywater is for the irrigation of non-edible landscape plants.

Description of process

A number of possibilities exist for greywater usage, including (1) collection of household washwater in buckets for indoor (toilet flushing) or outdoor usage (irrigation), (2) a hose from indoor greywater source directly draining to outdoor application, and (3) a greywater collection and treatment system followed by subsurface irrigation. The third option is the type of greywater system approved for use in California. In this system, greywater is collected in a separate plumbing system. The treatment generally consists of some type of filtration, a surge tank, and landscape distribution.

Advantages

Greywater systems can significantly reduce the amount of wastewater that needs to be handled with a wastewater treatment system. Using greywater for landscape irrigation can alleviate water

demand in areas that are prone to water shortages. Greywater systems are relatively inexpensive when included during building construction.

Disadvantages

Existing buildings may be difficult or impossible to retrofit with a greywater system. Greywater systems may not be appropriate in all areas. If not maintained, greywater systems may create human and environmental health problems.

Performance

Because greywater is not combined with wastewater from toilets and kitchens, it contains less carbon, nutrients, and pathogens. Subsurface application of greywater is considered to be a safe practice.

Operation and maintenance

Standard operation consists of being aware of what materials are being added to the greywater system and cleaning or changing of filtration devices. Simple greywater systems will require much less maintenance than mechanically intensive systems, however, simple systems may not be consistent with local codes.

Power and control

Some greywater systems may use pumps for movement of greywater to filtration systems and/or to irrigation systems.

Cost

Commercial greywater treatment and landscape irrigation systems (approved in California) are available for \$2,000 to 3,000, not including shipping and installation. The cost to install a separate plumbing system should also be included and will vary depending on site characteristics.

2-6.1 Center for Ecological Pollution Prevention

P.O. Box 1330

Concord, MA 01742

Phone 978/318-7033

Web www.cepp.cc

Description

WashWater Garden uses an engineered system for evapotranspiration of wastewater.



Fig 2-5

The WashWater Garden™ greywater treatment system. (Adapted from CEPP.)

2-6.2 Oasis Design

5 San Marcos Trout Club

Santa Barbara, CA 93105-9726

Phone (805) 967-9956

Fax (805) 967-3229

Web www.oasisdesign.net

Description

Greywater information including literature, consulting services, and other resources.

2-6.3 Clivus Multrum Inc

15 Union Street

Lawrence, MA 01840

Phone (978) 725-5591

Fax (978) 557-9658

Web www.clivusmultrum.com

Description

A greywater treatment system.

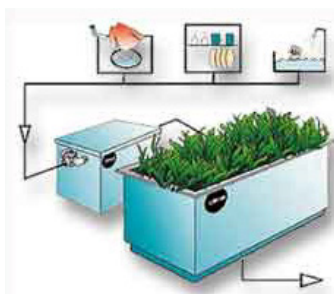


Figure 2-6

Diagram of the Clivus Multrum greywater treatment system. (Adapted from Clivus Multrum, Inc.)

2-6.4 ReWater Systems, Inc.

477 Marina Parkway

Chula Vista, CA 91910

Phone (619) 585-1196

Fax (619) 585-1919

E stevebilson@earthlink.net

Web www.rewater.com

Description

Provides design and installation of approved greywater filtration and subsurface drip irrigation system.



Figure 2-7

The ReWater filtration system and irrigated landscape. (Adapted from ReWater Sys Inc.)

2-6.5 Equaris Corporation

1740 Magnolia Lane North

Plymouth, MN 55441

Phone 763-383-5136

Fax 763-383-5155

E mail@equaris.com

Web www.equaris.com

Description

Equaris supplies complete greywater treatment and recycling systems.

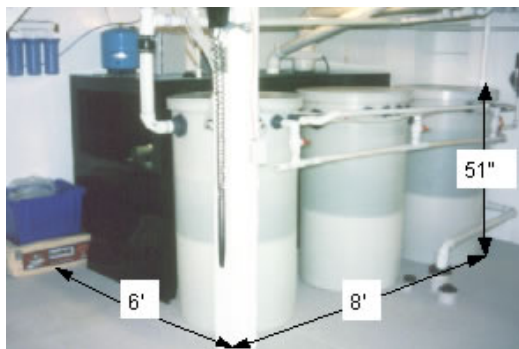


Figure 2-8

The Equaris greywater treatment system. (Adapted from Equaris, Inc.)

References

California Plumbing Code, Title 24, Part 5, California Administrative Code.

Del Porto, D., and C. Steinfeld (1999) *The Composting Toilet System Book*, the Center for Ecological Pollution Prevention, Concord MA.

Los Angeles Department of Water Reclamation (1992) *Graywater Pilot Project Final Report*.

Ludwig, A. (1998) *Create an Oasis with Greywater*, Poor Richards Press, Santa Maria, CA.